

## Designing a video library for senior users of iTV

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**Abstract.** The adoption rate of technologies by older adults is dependent on several factors, such as the identified potential benefits in the users' perspective. Designing and creating technology-based products since their beginning with potential end users, will help to guarantee a high rate use of these type of solutions, as verified in literature. In the scope of +TV4E project, which aims to deliver information regarding public and social services to older people through an interactive television (iTV) platform, this study analyses the best approach to implement a video library. This functionality allows the user to access a list of produced videos in the last days, categorized as "seen" and "unseen". Therefore, this article explores the process carried out to define the best approach to present a video library. For this, the research team presented to a sample of 4 seniors, three video library proposals developed concerning the design guidelines for iTV applications for elderly, supported on literature review. The data collection was followed by a cognitive walkthrough and a focus group session. Aspects as using different combinations to present the layouts and ensure that participants were not influenced, allowed to obtain results free of bias.

**Keywords:** elderly, iTV; video library; design

### 1 Introduction

Nowadays almost all developed countries are facing an inversion of the ageing pyramid with an evident grow of the number of elderly population. This trend has become increasingly visible over the last decades, it can be explained by the decrease in the fertility rates and by the fact that people tend to live longer. This happens mainly due to better health care, living conditions and sanitation [1]. Currently, the older population (people with 60 years old or over) reached 962 million in 2017, which represents 13% of the total population and by 2030 this number is expected to grow up to 1.4 billion worldwide. This phenomenon presents new challenges in multiple aspects of societies such academic and governmental. One of the possible ways to fulfil the needs and expectations of the elderly is related with the possibilities that technological solutions have. However, in order for technological solutions to be useful they must consider the ageing characteristics during their development process.

Being informed is a vital pillar to participate in today's society, which are increasingly becoming more and more dependent on quick and easy information access. This fact has been supported and improved by the technological revolution over the last decades. Having the ability to obtain information provides individuals with the knowledge needed to support informed decisions [2]. This is even more important when people grow older and, as a result of the normal ageing process, their capacities to acquire and understand information are affected which implies direct consequences in their quality of life. One of the areas where Portuguese elderly (and even younger people), have difficulty to access and understand information is public services. Seniors are at a clear disadvantage when it comes to accessing this information since it is mostly scattered across various mediums such as the internet, which requires a certain level of digital literacy. The access to this type of information influences not only the quality of life of individuals but also of those who are close.

As a response to the identified needs of Portuguese seniors, a research team from University of Aveiro is developing the +TV4E project. This work aims to promote the info-inclusion of Portuguese seniors through the delivering of informative contents, supported by an interactive television (iTV) platform, by interleaving the normal broadcast with informative spots related to public and social services accordingly to the user's profile [3]. During the definition of functional and technical requirements of the iTV platform, it was observed that a video library would be an added value for the elderly. This component of the +TV4E platform will allow the consultation of video spots already visualized, as well as to access videos that were triggered to the user but that were not visualized.

Academic literature and the experience gained daily reveals the importance of a developing process concerning innovative responses for elderly population to be carried out with the participation of target users. Neglecting this development approach may cause consequences in the technology acceptance, and more important, the solutions developed may not have a positive consequence in peoples' life.

Thus, this paper aims to present and analyse the process to define the best development approach regarding a video library. This work started with the definition of three proposals, previously developed by the +TV4E team considering the guidelines when building television (TV) interfaces for the elderly. The data collection was carried out following a cognitive walkthrough method and, afterward, a focus group with all the participants.

Additionally to this introduction, the article is organized in the following parts: section 2 presenting a theoretical framework on the questions of answers to fulfil the informative seniors' needs and guidelines to follow when building TV interfaces for the elderly; section 3 which illustrates the methodological steps followed to define video library available in the +TV4E project; section 4, where the obtained results are presented and discussed in detail; and finally, section 5 presents some of the conclusions drawn from this study as well as tracks to future work in this field.

## 2 Theoretical Framework

Worldwide, populations are facing a serious increase in the number of older people. Although this is a very positive phenomenon, supported in several enhancements in many areas of society, at the same time a new set of problems and challenges arises. To have an idea of the abrupt modifications in this age group, the report of United Nations [4] reveals that in 2017, 13% of the global populations are people with 60 years old or above, which corresponds to 962 million people. This segment of population is growing at a rate of about 3 per cent per year. Projections indicate that in 2030 the population with 60 or more years will achieve 1.4 billion, 2.1 billion in 2050 and could reach 3.1 billion in 2100 [4]. This phenomenon is inevitable, concerning the fertility declines and the increase in life expectancy rises hampered by the expected decrease of global populations (of 51 countries) between 2017 and 2050 [4].

Specifically, Portuguese resident population projections confirms this tendency and is expected that, in 2080, the ageing pyramid approaches an inverted triangle shape [5]. Between 2015 and 2080, the number of people with 65 years and more will increase from 2.1 to 2.8 million. Associated with the increase of older people and decrease in the number of youth, it is expected that the age index more than double, increasing from 147 in 2015 to 317 elderly people per 100 young people in 2080 [5].

The “active ageing” concept, is one of the firsts contributions with a global impact, that recognized ageing population as an important phenomenon. This concept encourages older people to remain active by working longer and retiring later, through engaging in volunteer work after retirement, and by leading healthy and autonomous lives. “Active ageing”, created by World Health Organization (WHO), is defined as the process of optimizing opportunities in three pillars: health, participation and security [6]. This will promote the elderly’s quality of life, highly influenced by the ability to maintain their autonomy and independence.

One of the living areas that influence older people’s quality of life is the access to information. This allows people to stay aware about their surrounding environment and consequently make decisions in a more supported manner [2]. In Portugal, despite information about social and public services being available in several service counters and online platforms, this information is sometimes shrouded in technical terms hard to decipher by most of the citizens. To make this process even more complex, especially to older people, access this type of information involves a pro-active behaviour by the user [7]. According to Silva and colleagues [2], information needs of the Portuguese elderly encompass: health care and Iconography’s development for a seniors’ iTV informative platform welfare services; social services; financial services: cultural, informal education and entertainment; security services; local authority services; and transport services.

Technological products can help seniors to have a higher quality of life levels, and one of the solutions with great potential to supports elderlies are interactive TV applications mainly due to the time that seniors spend in from of TV. In this context, an academic project is under development that aims to develop an iTV platform, specially designed for the elderly and based on simple interactions, that delivers information

about social and public services through brief video spots, without active search performed by the user. The video library is an important platform enhancement that strengthens the overall solution for elderlies. This extra feature, will provide the videos generated on the last five days, categorized as seen and unseen. The development of new innovative products should be conducted, since the beginning of the process, with inputs from potential end users that represent the target population [8].

An extensive study regarding guidelines to follow when building TV interfaces for the elderly has been conducted in the context of +TV4E project. This study focused on a literature review regarding the specific characteristics of the seniors that come from the ageing process, such as loss of hearing and visual acuity [9]. These need to be taken into account when developing software for seniors to guarantee good usability, however, since there is no sound in video library only recommendations regarding visual content need to be considered, specifically regarding text, icons and colours. These guidelines are following resumed, based on the study of Reis and colleagues [9].

Most notably, loss of vision in seniors causes them to have difficulties in focusing at short distances, distinguishing small details, discriminating chromatic differences and reading moving text. It also reduces their adaptability to lighting, makes them more susceptible to brightness and requires them to have more luminosity when reading for example. To counter these limitations there are several design recommendations to make visual content more suitable for the elderly. In general, the literature suggests that text in screens should be at least 40pts, the fonts with serifs, the italic or decorative elements should be avoided, text should be aligned to the left, the spacing between lines needs to guarantee fluidity and readability and there should be high contrast between the background and the text. When it comes to icons, they should be the combination of an image and text, never one without the other, be easily distinguishable and avoid the use of abstract concepts or graphical conventions associated with recent digital technologies. Lastly, the colours need to be chosen carefully to consider the limited colour spectrum of televisions and the seniors' needs. Concerning this, the development of the video library available on +TV4E platform will take into account all the orientations presented above and also the inputs gathered from potential end users. So, in the coming section, the methodology used to select the preferred layout for the +TV4E platform is described in detail, going over the objectives of the study, the sample and the whole process.

### **3 Methodology**

This study aims to access the preferences of older people concerning the best video layout that will be supported in the +TV4E platform. Thereafter will be described in detail the methodology followed, namely the objectives, sample and the process carried out.

#### **3.1 Objectives**

The present study was performed with the main objective of determining the best approach to implement a video library, which would serve as a component of the iTV

application being developed under the +TV4E project. The main purpose of this video library is to allow the users to visualize the informative videos provided by the platform in a different manner, that would be similar to an on-demand video service. In the library, the users are able to re-watch videos they had already seen and watch videos they reject or missed, therefore complementing their user experience and giving them some degree of control over the system. With this in mind, three layouts proposals were developed in order to be presented to the seniors for the sake of validating them and ultimately choosing the most suitable solution.

A state of the art review was carried out prior to the designing of the layouts in order to identify the current trends in iTV applications for seniors. All the layouts share several similarities, being the header displaying the name of the interface, as well as telling the user how to return to the TV broadcast or how to access the settings menu. Besides sharing the same header, all the layouts are based on video cards, although the information shown in the cards varies per layout. In the case of the interface proposed in this work, the lists only contain videos from the last five days and are sorted chronologically, having the newest videos shown first.

The first layout (Fig. 1) one of the examples of a horizontal navigation where the top lists shows unseen videos while the bottom list shows seen videos. It is also the simplest proposal since each card contains the least amount of information, in this case the title, and the duration of the video.



Fig. 1. Layout 1

Layout 2 (Fig. 2) was based on one of Netflix interfaces, this layout featured a horizontal navigation, similarly to layout 1, however it included a lot more information. In this layout, the users are presented with a lot more information, since the two video lists for seen and unseen videos are condensed to the bottom half of the layout, in order to include a section with details of the selected video. In this details section, it shows the title of the video, a small description based on the first paragraph of the news article, the duration of the video, the thumbnail and how long ago the video was created.



Fig. 2. Layout 2

Lastly, layout 3 (Fig. 3) is a variation of layout 1 where the navigation is done vertically instead of horizontally. In this proposal, each list only shows two cards on the screen, which leaves room to include more information, so the date of the video was also included and the font for the title is bigger.



Fig. 3. Layout 3

It is also important to mention that none of these layouts were refined to the point of them being considered final. Since the main goal of this study was to assess which of these navigation typologies, vertical or horizontal, was best suited for the project's target demographic and what kind of information was most relevant to be displayed.

3.2 Sample

The sample for this study which took part in the data collection moment consisted of four participants, 50% males and 50% females, all of them over 65 years old and were students at a Senior University of Curia. They were selected via convenience sampling

due to the difficulty of selecting a random sample. The participants were already familiar with the project, since they had already been involved in previous data gatherings, where other visual elements of the iTV platform were defined. Next the testing process will be described.

### 3.3 Process

In order to develop an interactive TV platform which is both attractive and adequate to the target demographic it's essential to resort to a participative design process where the final users are consulted, thus helping in defining the final result.

Currently the ongoing process of participatory design in the context of +TV4E project is being carried out in two senior universities located in the district of Aveiro. These moments occur during the evaluation of key parts of the project. The data gathered in each of these moments is analysed and used to improve the current state of the iTV application. The results achieved are then presented in the next session. As stated above, developing a platform that is intuitive and easy to use is essential to ensure high levels of success among its users. At the moment, the video library is a hub where it is possible to access all the information provided by the application and it is also the only interface in the iTV application where the users are required to navigate. Therefore, it's important to guarantee that the navigation meets the users' needs and expectations.

Thus, since in the context of the +TV4E project the researchers want that all the elements of the platform are designed and tested alongside the end users, an experiment was conducted with a restricted number of participants to assess which of the three video library layouts was preferred. Each layout represents one way of presenting the information and the navigating between it.

Due to the limited size of the sample, the experiment was designed so that each one of the participants had the opportunity of navigating inside each one of the layouts so that the choice of the preferred layout was based on actual user experience and not solely based on expectations.

This experiment was divided in two parts, an individual cognitive walkthrough, which in turn was separated in three different moments, and a focus group with all the participants afterward.

Considering the demographic of the study, the researchers took care in using clear and concise language with all participants throughout the entire process, while also avoiding any technical terms that might confuse or demotivate the users.

The cognitive walkthrough would start with the investigator contextualizing the user about the experiment. To start the participant was informed about the results of the previous data gatherings since, as stated above, the participants took part in previous +TV4E studies and then contextualized regarding the experience that was going to take place. Subsequently, it was explained to the participant that he would be able to interact with three distinct layout proposals for the video library, where they could visualize videos they missed and videos they had seen previously, which would be later included in iTV application.

Additionally, each participant was informed that after testing the three interfaces he would be asked to wait in a room while the other participants finished their tests.

This last step was necessary, considering the goals and sample the team had to find an adequate test that would allow all users to experiment every layout in order to form an opinion about each one. However, due to the lack of multiple television sets it was not possible to run all the user tests in simultaneously. Thus, a specific approach was needed that would not allow the users to influence each other's opinions between tests, so after some deliberation, it was decided that users needed to remain isolated from each other while the individual test was ongoing.

Following the contextualization, the participants were informed that they could freely explore each of the three interface layouts, but also needed to perform some simple tasks while doing so. These tasks were designed with the goal of making the users explore the most important features in the video library, which are to watch seen and unseen videos. They consisted of changing between the two video lists, counting the number of videos in a list, watching a previously watched video and watching a specific video given its title.

So that the participants would not be confused when asked to view a video they had previously seen, the test began by showing them an informative video before proceeding to open the video library. Following this step, the participants went through each of the layouts while performing the tasks listed above.

To conclude the cognitive walkthrough phase, the participants were asked some short questions regarding their user experience, this helped in gathering the individual opinion of each participant before having them discuss their opinions during a focus group. The following questions were asked:

- a) Which of the three options is most appealing to you? Can you explain why?
- b) Was it easy to navigate between lists? In which option was it easier?
- c) Do you have any suggestions that can help making this solution easier?

The steps above were repeated for every participant with the only difference being that the sequence of the presented layouts was shuffled to avoid the users from becoming biased by the order of the layouts. With this in mind four showing combinations were used which are as follows:

- a) 1-2-3;
- b) 2-1-3;
- c) 3-2-1;
- d) 2-3-1.

Following the cognitive walkthrough, all the participants were gathered in testing room to begin the focus group, as it can be seen in Fig. 4. The participants were then encouraged to share their opinions regarding their experiences. In the end, they were required to choose their preferred layout, which needed to be a group decision.





**Fig. 4.** Focus Group moment

In the next section, the results of this study are presented alongside with a discussion pertaining their implications in the final product.

## 4 Results and Discussion

The present study wielded both individual results for each participant and a group decision for the best overall interface layout. The individual results are synthesized in Table 1 and include all the suggestions, made by the users during testing (see Fig. 1, Fig. 2 and Fig. 3).

**Table 1.** Individual results for each layout

	Layout 1	Layout 2	Layout 3
Subject 1	The video cards are easy to distinguish since the title occupies less space	The selected video is not big enough. The lighter colours are not distinct.	The background colour cannot be distinguished from the cards.
Subject 2	The play symbol should be blinking to make it clear that it plays the video.	Headers should be bigger. The font should be changed or have a different colour.	Vertical navigation is better than horizontal. Having two cards per column is appropriate since they are bigger.
Subject 3	Liked it because it was simple and easy to navigate. Should have less cards shown on screen.	Has too much information. Should have less cards shown on screen.	Easy to understand which card is selected. Two cards per column makes it easy to read.

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Subject 4	Duration of the video is important to keep. Intuitive navigation.	Too much information makes the layout confusing. Number of thumbnails is appropriate.	Prefers horizontal navigation.
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Regarding each of the individual participants preferred layout, all participants with the exception of participant 2 choose layout 1 as their favourite.

Since most participants already chosen layout 1, the focus group results were very similar to the individual results. In the end, the majority of the participants preferred layout 1 due to it featuring a horizontal navigation and fewer interface elements. The participants justified this by saying they were already familiar with the horizontal navigation, therefore making it easier to use. The focus group participants also decided that the appropriate number of video cards per list should be three, in order to allow them to be bigger and thus easier to read.

## 5 Conclusions and Future Work

Developing technologies that cater to needs of seniors is paramount to promote their quality of life. The quality of life can be measured in terms of independence from their informal networks, such as, the informative dependence of their caregivers and dependence while doing day-to-day activities, such as shopping, eating and dressing.

In the end, this study was considered successful since the participants clearly understood the purpose of the tests and it was possible to get a clear decision between the all of them. The results were consistent and the fact that the layout showing order was different for each participant, further indicates that the chosen layout was the most appropriate.

Following the final choice of layout 1 and considering that the layouts were not finalized, the next step was refining it with the participant's suggestions. One of the main complains regarding layout 1 was the number of cards shown on screen, so the number of cards will be reduced to three per list. The background colour was also a problem for some users so the contrast between the cards and the background will be further increased to circumvent this problem from happening. The font Tiresias was well received by all the participants, although the title of each list should be increased to make them easier to read.

The improved version of layout 1 was integrated into +TV4E project iTV application and is being evaluated at the moment as part of another ongoing +TV4E study. This study is being carried out in a domestic environment with real context users and has the goal of testing the first iteration of the application as a whole.

However, there is still room for improvements when it comes to the video library. The team is already considering the inclusion of sound in the video library, specifically the addition of sounds when switching between cards and lists. This would provide the users with an auditory reinforcement to make it clear they changed between cards or lists and would also address one of the problems raised by some participants.

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